REMARKS

This is in response to the Office Action dated November 13, 2006. In view of the foregoing amendments and following representations, reconsideration is respectfully requested.

On pages 2-4 of the Office Action, claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pham et al. (U.S. Patent No. 6,051,125) in view of Gregg (U.S. Patent No. 4,229,184) and one or more of Chiaramonte (U.S. 4,312,740) or Keller et al. (U.S. 4,953,479) or Shaw (U.S. 6,736,955).

In the response to arguments section of the Office Action, the Examiner indicated that more data supporting the conclusions discussed in the previous response was needed. Thus, the following data (Exhibit I and Graphs 1-3 - attached hereto) and explanation thereof is provided.

The inventor of the present invention conducted experiments of the electrolytic process in order to study the difference in carbon deposition in the process of the present invention and that in the prior art process which employs methane as the reducing gas.

Initially, an experiment was conducted according to the present invention as follows. Under a temperature of 734°C, steam was supplied into a cylindrical electrolytic cell, and a simulated pyrolysis gas (H_2: 58.6%, CO: 24.1%, CO_2: 12.4%, methane: 4.8%) was supplied to the outside of the electrolytic cell. In this state, a voltage was applied between an outside electrode (anode) and an inside electrode (cathode).

The voltage-current curve obtained during the experiment is represented in Graph 1. The following information can be gleaned from Graph 1. When the current was zero, the voltage was

-180 mV. As the current increased, the voltage also increased substantially linearly. Thus, it was confirmed that continuous electrolysis was able to be performed stably.

Next, the experiment was conducted using methane instead of the simulated pyrolysis gas. The results of this experiment are also shown in Graph 1. In the case of methane, when the current was zero, the voltage was -360 mV. However, as the current increased, the voltage sharply increased. As a result, a higher voltage was required in comparison with the voltage required in the present invention. This means that higher electric power is required when producing the same amount of hydrogen, and that significant advantages are obtained by using pyrolysis gas instead of methane.

Further, in order to study whether or not carbon was deposited on the electrode as a result of the electrolysis using methane, an inert gas (N_2) was introduced into the apparatus in order to expel (purge) the methane, and then humidified nitrogen gas ($N_2 + H_2O$) was supplied to the electrode. More specifically, N_2 gas was introduced for about 600 seconds, and then $N_2 + H_2O$ was supplied to the electrode. As a result, as shown in Graph 2, CO and CO_2 were produced from the electrode. This is due to the fact that the carbon gas was deposited on the electrode as a result of electrolysis using methane and that carbon reacted with H_2O to thereby produce CO and CO_2.

As previously discussed with reference to Graph 3, carbon deposition from methane occurs at temperatures of more than 550°C, while carbon deposition from CO occurs at temperatures of less than 700°C. Since electrolysis is performed at a temperature of approximately 800°C, carbon deposition from CO will not occur at this temperature. Therefore, the inventors of the present

invention have discovered that the use of a reducing gas composed mainly of hydrogen and carbon monoxide (CO) can avoid the carbon deposition problem. In view of the significant advantages obtained by the process set forth in claim 1, it is submitted that claim 1 would not have been obvious in view of the teachings of the various references as applied in the rejection.

In view of the above, it is submitted that the present application is now clearly in condition for allowance. The Examiner therefore is requested to pass this case to issue.

In the event that the Examiner has any comments or suggestions of a nature necessary to place this case in condition for allowance, then the Examiner is requested to contact Applicant's undersigned attorney by telephone to promptly resolve any remaining matters.

Respectfully submitted,

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